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INTERRUPTIONS ON TELEPHONE CONVERSATIONS

BY

K. W. WATERSON
American Telephone and Telegraph Company

A DISCUSSION OF
VARIOUS INTERRUPTIONS OF TELEPHONE CONVERSATION
OUTLINING SOME CAUSES AND PREVENTIVE MEASURES

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Typical telephone switchboard in operation.

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The "Cutoff"

IT occasionally happens that a telephone conversation which is proceeding satisfactorily is interrupted by what is technically called a "cutoff". Although cutoffs are relatively infrequent, the annoyance to users is great, not only because of the interruption itself, but also because of the delay in reestablishing connection which often results when both parties are at their telephones and both are trying to restore the connection. It may be helpful to describe some ways in which cutoffs occur, their average frequency and some of the methods employed to prevent them.

From the viewpoint of the telephone users in the larger cities, interruptions which are generally classed as cutoffs occur on the average, six times in a thousand local conversations. On three of these an actual severing of connection has taken place due to some feature of telephone company operation. The other three are the result of some action at the calling or called station or private switchboard, and in many of these cases the connection, in so far as it is controlled by the telephone company, has not been disturbed. Whatever their cause, the prevention of interruptions is a matter of great concern since about 15 per cent. of the criticisms of operators' work arise from this source.

Cutoffs Due to Telephone Operation

Considering first the three cutoffs per thousand calls attributable to telephone operation, they are due to an accumulation of possibilities for failure inherent both in human effort and in extensive electrical plant. Calls in large cities involve two, and sometimes three, operators. The calling operator illustrated on the photo-

graph of a typical subscribers' switchboard, makes two movable connections by inserting plugs into jacks, and if either is removed by mistake during conversation, a cutoff results. The operator at the called office, and also at the intermediate office, when one is involved, makes one movable connection between plug and jack. Thus there are either three or four points of contact where the connection may be severed purely through an operator's mistake, and such mistakes cause one and a half cutoffs in a thousand calls. Calls passing through a private switchboard also have two additional plugs which might be removed in error, and thus a call from a user at one large business establishment to an extension at another large firm may have seven or more vulnerable points.

Much effort is expended in designing telephone plant to make it proof against mechanical or electrical failures. It is well understood, however, that with any extensive electrical plant involving cords, lamps, coils, relays, soldered connections and other contacts, there are always possibilities for trouble to creep in. A conversation within a large city such as we have been discussing is held over physical plant which includes about 15 movable contacts, some 400 soldered or mechanically secured connections, and 50 other contacts where temporary trouble might develop, causing mechanical breaks in the circuit or giving false disconnect signals to the operator. When the connection passes through private switchboards, about 200 more contacts are added to the line. While the probability of trouble developing at any individual point is very small, the number of such points is large. It is estimated that equipment in trouble of one kind or another causes about half of the cutoffs attributable to telephone company operation, or about one and a half cutoffs in a thousand calls.

Cutoffs on conversations from dial telephones occur less frequently than on connections completed manually. There is less opportunity for human error, although

chances for mistakes at private switchboards and at subscribers' instruments are still present.

In smaller cities where there is only one telephone office, telephone conversations are less likely to be interrupted since only one operator is involved in completing calls and there is considerably less equipment than in the larger places.

Long distance connections, on the other hand, pass through more equipment and involve more operators, and cutoffs average somewhat higher, about ten calls in a thousand being affected in spite of the precautions taken to prevent interruptions On the average long distance connection there are four operators, not including operators at private boards, and six plugs which might be taken down by mistake. Many long distance calls pass through one or more intermediate offices, with another operator with two cords, added to the operation at each such switching point.

In a long distance cable connection from New York to Chicago, for example, there are about 1,500 relay or key contacts and 9,000 other fixed contacts of different kinds, in addition to some 40,000 soldered connections in the toll line itself. All long distance calls are subject to more physical hazard than local calls, and still more when completed over open wire toll lines than through toll cables. The covered cables afford protection from certain kinds of trouble to which open wires are exposed.

Prevention of cutoffs is a matter which has received careful attention by the telephone organization. Equipment has been designed to throw every practical safeguard against the accidental taking down of talking connections. Operating methods and practices have been worked out to reduce the likelihood of operators' mistakes. Cords and lamps on switchboards are colored alternately white, red and green so that operators can identify connections and give them definite association with the disconnect signals on the position and with the plugs in the particular lines.

The chances for operators' mistakes are greatest when a large number of cords are in use on a position or when a plug adjacent to a talking connection is disconnected. The picture of a typical switchboard illustrates some of the conditions encountered. Considering the complications of handling the calls on switchboards, a remarkable job is done in keeping the number of cutoffs caused by any individual operator down to about one in fifteen hundred calls handled. This is less than one cutoff per operator in a full day's work.

Operators are taught to follow technical practices which will prevent mistakes in disconnecting. Definite ways of selecting cords have been developed to reduce cord tangles to a minimum and methods of tracing cords when congestion is unavoidable are used generally. Operators are taught to disconnect on the calling party's line first so that they will immediately receive a warning light if an error has been made and correct it before the conversation is seriously disturbed.

An operator assisting in taking down connections on an adjacent position safeguards against cutoff by holding plugs with a certain position of the fingers and awaiting teamwork signals from the adjacent operator to indicate that she is taking down the right cords. There are many other measures of this sort in general use, and while some of them seem of little consequence when considered individually, in the aggregate they make substantial contribution to the prevention of cutoffs.

On the equipment side, also, many special practices are necessary to insure proper operation of the equipments. Cords are frequently tested and those found to be defective or in questionable condition are immediately taken out of service.

All central office equipments are given rigid tests frequently for indication of defects. Toll lines and toll equipments which contain complicated apparatus are subject to frequent inspection and constant supervision.

Cutoffs Due to Other Causes

Occurrences at subscribers' stations or private boards, which account for about three cutoffs per thousand calls, fall into two general classifications—those which really break down the connection and those which give that impression, although the connection has not been disturbed. Private exchange operators disconnect by mistake in the same way that company operators occasionally do. There is also a possibility of private exchange operators giving false disconnect signals to the company operators in several different ways, and this would, of course, result in the connection being taken down.

In the other group are cases where the private exchange operator fails to follow up calls to extensions slow in answering and fails to advise the calling party of conditions, with the resulting impression of cutoff on his part. The same impression may be given when a particular person has been called to the telephone but is slow to respond, and this may occur at single line stations as well as at private boards. The calling party may disconnect in some of these cases, and when the called party finally comes to the telephone he thinks a cutoff has occurred. Sometimes one party or the other leaves the telephone to look up information and is slow to return, and the impression of cutoff is given to the party waiting. Occasionally a private operator or subscriber, busy with other matters, stops the ringing signal without answering immediately, with the same unsatisfactory result.

Telephone users can therefore make substantial contribution to the improvement of cutoffs. Those having private exchanges have an opportunity to prevent cutoffs or conditions so classed, by making sure their own operators are proficient and that the most efficient telephone practices are employed both by the private exchange operators and extension users. Whenever possible, it is helpful to avoid having the private exchange operator obtain the called party before the calling user comes to the

extension. If the private exchange operators give close attention to calls for extension stations which are slow in answering, some impressions of cutoffs will be cleared up. The telephone companies have specialists on private exchange operation who are always glad to assist subscribers in instruction work and on all matters involving the operation of these boards.

If a cutoff does occur, the quickest way to get the connection reestablished, is for the called user to hang up his receiver and allow the calling user to order the connection restored. This simple rule will help materially to keep out complications and delays which sometimes arise when both parties remain at the telephone and try to restore the connection at the same time.

Considering all the conditions involved, it seems fair to say that the measures taken to prevent cutoffs have reduced this service failure to a low point. Since 1920 there has been a reduction of 40 per cent. in the average number of cutoffs in a thousand calls. Even with a low average, however, these annoyances will not be distributed evenly and some subscribers will receive more than others. As long as there are any such occurrences, their prevention will be a matter of great concern to those responsible for giving telephone service as well as to the subscribers themselves. Constant attention to the matter by the entire telephone organization is therefore necessary, and if users of the service also assist wherever possible, it will always be a valuable contribution.

Intercepted Calls

Telephone users occasionally ask this question: "After I have given my call to the operator, why does she ask me a few seconds later, 'What number are you calling, please?' " When this condition is encountered, one is likely to think that the operator has forgotten the number and that no progress has been made on his call in the meantime.

The fact is that definite effort has been made to complete his call but that completion has failed, for one of a number of possible causes, and the call has, therefore, been transferred to a special operator called the Intercepting Operator so that the correct action necessary to complete the call may be determined.

In a large city, about twenty-five calls out of a thousand are sent to the Intercepting Operator. Of these twenty-five calls, fifteen require action by the Intercepting Operator, and ten are calls that might have been completed by the regular operators. It may be of interest to consider these two groups of calls separately.

Calls Properly Routed to Intercepting Operator

Of the fifteen calls out of a thousand that are properly sent to the Intercepting Operator, thirteen are due to causes over which the telephone company has no control. A subscriber may have moved from one part of the city to another, necessitating a number change, or he may have moved to some other city, necessitating the disconnection of his telephone. Or, perhaps, the number has been changed because of the opening of a new office, brought about by growth.

The remaining two of the fifteen calls in this group are due to a variety of causes, such as a line out of order, an error in the telephone directory, or service temporarily discontinued.

Calls Improperly Routed to Intercepting Operator

As noted above, ten calls out of a thousand are sent to the Intercepting Operator instead of being properly completed. About nine of the ten are due to some error on the part of the operator or the subscriber, the errors being equally divided. About one of the ten calls is due to equipment trouble or to a variety of causes.

There is no single outstanding fault that explains this condition but rather a number of causes, some of them

being chargeable to the operator, some to the subscriber, and some to the equipment.

Errors Due to an Operator

1. Starts to work on the call before understanding the number desired.
2. Selects a trunk to an office other than the one desired.
3. Passes the digits of the number incorrectly.
4. Passes the number correctly but terminating operator misunderstands it.
5. Terminating Operator understands the number correctly but makes a mistake in selecting the desired multiple jack out of several thousand to which she has access.

Errors Due to Subscriber

As is indicated by the following, the calling subscriber may have placed his call in such a way that it was routed to the Intercepting Operator:

1. Relies on his memory and calls a number other than the one he wants, the number called not being in use, and the call therefore being properly routed to the Intercepting Operator.
2. Speaks indistinctly in giving his order to the operator.
3. Dials before hearing the dial tone, forces the dial back, makes an error in dialing, or removes his receiver when another station on the line is dialing.

Errors Due to Equipment Trouble

If the call is from a dial telephone, most of the operating errors mentioned above are eliminated but they

are replaced in part by various equipment reactions resulting from the use of additional machinery in place of operators.

Means for Decreasing Intercepted Calls

While some intercepting service is an inherent part of the general telephone service, some of the above causes of error are subject to a certain amount of control. Most of this naturally falls on the telephone company but the subscriber may assist materially. Their separate fields are shown below:

The Telephone Company

With a view to minimizing the number of calls sent to intercepting operators, the telephone company is working to train all operators to perform their part in establishing telephone connections with the minimum error consistent with any human effort, keeping in mind the importance of accurate service in the design of all new equipment and in the selection of operating methods. Care is also taken to see that all subscribers' lines are connected to the terminals assigned and the entire physical plant is maintained at the highest practical standard. Continual studies are being made with a view to selecting office names subject to the minimum confusion. Efforts are also being made to place in the hands of each subscriber a directory that is free from error and to keep Information and Intercepting records up to date on all changes in listings that occur between directory issues. Subscribers' numbers are not changed except where such changes are unavoidable.

The Subscriber

The subscriber may aid materially by consulting the latest issue of the telephone directory if he is at all doubtful of the number of the person desired. If a ready reference list of numbers is kept, it would be well to correct

it after receiving a new issue of the directory. In giving the number to the operator one should speak clearly, with the lips close to the mouthpiece but not against it. If the subscriber is served by a dial office, the number should be dialed in the manner described in the information pages of the directory.

Of course, the above lines of effort are not new either to the subscriber or to the telephone company, but constant effort along the lines mentioned should result in a minimum number of calls routed to the Intercepting operator.

"Wrong Number" Calls

Wrong number calls result in annoyance and loss of time, whether the error is attributable to the telephone company's employees, or to the subscribers themselves.

In a large city usually two operators, and sometimes three, are needed to complete a local call. A considerable amount of expensive plant is tied up for a short time on each call. If the call results in a wrong number, the expense for the operating labor and for the equipment involved is entirely wasted, as the operator who answered the call must start her work again.

Since a "wrong number" call is an annoyance both to the person making the call and to the person called in error and since it is objectionable to the telephone company both from the service standpoint and from the standpoint of economy in operation, it may be of interest to consider the causes of wrong numbers and the steps that are taken or that may be taken to minimize them.

In a large city, about twenty-three calls out of a thousand result in a wrong number. Of these twenty-three calls, thirteen are calls on which the telephone company is partly or wholly at fault; ten are calls on which the number given by the person calling was not the number he wanted.

Wrong Number Calls Attributable to Telephone Company

As noted above, on thirteen calls out of a thousand the telephone company is partly or wholly at fault. In some cases, the number has been passed clearly to the operator but a mistake has been made by that operator or by another operator involved in completing the connection. In other cases, the number may not have been clearly passed to the operator due perhaps to faulty articulation or to failure to speak into the mouthpiece of the telephone. These cases are included in the thirteen wrong number calls mentioned above.

A further analysis may be made of the thirteen wrong number calls in a thousand that are chargeable to the telephone company. Of these thirteen calls, five are due to a misunderstanding between the operator and the subscriber; six are due to a misunderstanding between operators; one is chargeable to the answering operator for completing the connection to an office other than the one called; one is due to one of several causes, the chief error being charged to the terminating operator for completing the connection to a station other than the one called.

While five wrong numbers in a thousand calls are due to an error between the operator and the calling subscriber, it will be noted that the percentage error is small, only half of one per cent. No service, involving human effort and mechanism, can ever be entirely free from error. As noted above, the call may have been passed clearly and yet misunderstood by the operator, or it may have been subject to faulty articulation or failure to speak into the mouthpiece of the telephone.

The telephone company is wholly responsible for the six wrong numbers in a thousand calls resulting from a misunderstanding between operators. In order to reduce these errors to a minimum, each operator receives training in voice work before she is permitted to handle calls. Because of the similarity in sound between some of the

ten digits in the group from 0 to 9 inclusive, the operators are taught to pronounce each figure in such a way as to minimize the confusion of that figure with any of the other figures. Perhaps the best known example of this is the pronunciation of the figure "3" as "th-r-ee", the letter "r" being slightly rolled. It will also be noted that the figure "4" is pronounced "fo-wer", the figure "5" as "fi-iv" and so on. Since 1920, the wrong numbers for which the telephone company is responsible have decreased from twenty-six to thirteen per thousand calls. A very large part of the gain has been due to more accurate service between operators. The work along this line is necessarily continuous, and it is hoped that some further improvement may be obtained.

It will be noted that one wrong number in a thousand is due to the fact that an operator completes the connection to an office other than the one desired. This is very low when the possibilities for error are considered. In a large city surrounded by a highly developed suburban area, the operator must deal with some hundreds of central office names. In selecting names for offices in a large city, each name is tested by having one operator pronounce it over a telephone circuit to another operator. Lists of names are tested in this manner, the test being repeated many times with different operators. Care is used to select names different in sound from other names in use in that city and in the nearby suburban area.

In order to complete the call, an operator must first select the group of trunks to the desired office and then select an idle trunk in that group. In a large city, the proper trunk group must be selected from a hundred or more groups of trunks located in front of the answering operator. The accompanying photograph will give an idea as to the problem that the operator has in selecting the proper trunk group out of a large number of groups of trunks. Every known method is used to mark the trunk groups clearly and to acquaint the operators with the location of each trunk group. The small percentage of

errors due to these causes indicates that the work is effective.

And finally one wrong number in a thousand calls is due in part to an error of the terminating operator in selecting the proper number out of several thousand numbers in front of her, and in part to a number of causes such as errors in records, errors in connecting a telephone properly to the central office through the overhead and underground cables and the various frames at the central offices, and similar causes. In view of the many possibilities for error that these various causes afford, the actual errors attest the emphasis placed on accurate work by the telephone company in these various phases of the work.

Wrong Number Requested by the Person Calling

On ten calls out of a thousand, the number requested by the person making the call is not the number that he really wants. This is usually caused by calling from memory when one is not really sure of the number desired, by calling from an old list of numbers, or similar causes. The service is made to appear somewhat worse when the person who makes the mistake fails to apologize for it on receiving an answer, and charges the mistake to the operator.

While the wrong numbers chargeable to the telephone company have decreased from twenty-six to thirteen out of a thousand calls since 1920, on the other hand the wrong numbers requested by the person making the call have stood at ten out of a thousand calls or now nearly half of the total wrong numbers.

It is the purpose of the telephone company to supply each subscriber with a copy of the latest issue of the telephone directory containing an accurate list of telephone subscribers as of the date of issue. If a listed telephone is later disconnected, special arrangements are made to route a call for this number to an intercepting

operator who will give the calling party the new number of the telephone in question or will tell him that it has been discontinued. If a new telephone is installed, special records are provided at the Information board so that subscribers may readily obtain this number. When the next issue of the directory is made, these special records are then canceled.

It is, therefore, important for a subscriber to consult the directory before making a call instead of calling from memory or from an old list of numbers. The telephone company frequently stresses this point to the end that an increasing proportion of the subscribers will follow this practice with a resultant decrease in the proportion of wrong number calls due to this cause.

How to Reduce the Proportion of Wrong Number Calls

The telephone company is constantly working to improve both the equipment and the methods, and as mentioned above the wrong numbers for which the telephone company is partly or wholly responsible have decreased substantially.

The telephone user can help materially in reducing the quantity of wrong number calls by looking up the number in the current issue of the telephone directory, and fixing the office name and the figures of the number well in mind; and by speaking clearly with the lips close to the mouthpiece but not against it. If a dial telephone is used dial the letters of the office name that are capitalized and then the figures of the number followed by the party line letter, if any.

It will be seen from this brief review that there are many conditions which may cause a "Wrong Number" call. Some are wholly within the control of the telephone company and some are wholly within the control of the subscriber. While there will always be some wrong numbers, definite effort by the telephone company and the subscribers, along the lines indicated in this paper, should

result in a decrease in Wrong Number calls and a corresponding improvement in the general telephone service.

"My Bell Rang" Reports

When one answers a ring on his telephone and is told by the operator that "There is no one on your line now. Will you excuse it, please?" there is naturally annoyance mixed perhaps with wonder at the reason for such a condition. Occasionally the person who was called will ask the operator who called him and he may be further annoyed when he finds that she is unable to tell him.

Before discussing the reasons for these occurrences, it may be helpful to explain that in large cities, each telephone office is equipped with two separate switchboards. At one switchboard, a group of operators answer outgoing calls that are made by the subscribers served by that office, these calls going to the various offices in that city, to nearby toll towns, or to the long distance board. At the other switchboard, a group of operators complete incoming calls to the subscribers served by that particular office, these calls coming from the various offices in the city and out. In a dial office, there is a similar division of the equipment for handling outgoing and incoming calls.

When one encounters a "Bell Rang" condition, it means that a call has been completed to his telephone by an operator at the incoming board in the office serving him, and that the connection at the incoming board has then been taken down for some reason. Under these conditions, when the receiver is removed from the hook, in answer to the ring of the bell, a lamp lights in front of an operator at the outgoing board. This operator has no knowledge of the previous incoming call and can only apologize for the resulting annoyance.

About nine out of a thousand calls result in "Bell Rang" reports. In 1920, this figure stood at twelve, but along with other improvements in the service, this item has gradually improved.

Why should there be any cases of this sort? That is a natural question to ask, and it may be of interest to consider the major irregularities which result in "Bell Rang" reports. In some cases, the telephone company is responsible and in others a subscriber is responsible. In the discussion that follows, the irregularities are grouped in accordance with the responsibility.

Irregularities Attributable to the Telephone Company

After a subscriber gives a call to an operator, he presently hears her pass the number to the completing operator. The latter operator then completes the connection to the number called, if it is not busy, and the ringing starts automatically.

Sometimes the calling subscriber notices that his operator made a mistake in passing the number to the completing operator and he corrects the mistake. His operator then disconnects from the trunk first used, and passes the correct number over another trunk to the completing operator. The act of disconnecting from the first trunk gives a signal to the completing operator who then disconnects. The successive operations are so rapid that frequently disconnection occurs before the called station is rung. In other cases, it occurs after the called station is rung, and in that event there is no one on the line when the called station answers. About half the irregularities chargeable to the telephone company are due to this cause. There are, however, a number of operating and equipment irregularities which may cause "Bell Rang" reports.

For example, the completing operator may complete a connection to a wrong number, recognize her mistake, and correct it. A cutoff may occur before the called station answers. If the calling party signals before the called station answers, the operator may in error take down the cord on which the called station is being rung.

In addition to operating errors, there are some other

conditions that may cause "Bell Rang" reports. When a plant man is working on a line, he may accidentally ring the bell or cause bell taps which are mistaken for a ring. Due to faulty adjustment, the bell may tap when another station on the line is using it. Following a long distance call, the "disconnect ring" of the distant long distance operator may, under certain conditions, be heard by a subscriber who has just finished talking on a long distance call, and by the time he answers, the connection may have been taken down.

As these operating and plant irregularities aggregate less than one case in a thousand, they, of course, have a very small effect individually.

Irregularities Attributable to the Subscriber

Of the nine "Bell Rang" reports in a thousand calls, seven are due to the fact that the person who made the call did not wait long enough for the called person to answer the call. In about half the cases, the person making the call disconnected very quickly. In the other half, the person called was a minute or more in answering. Undoubtedly, there are excellent reasons for both conditions, but it is to be noted that seven out of the nine cases are due to this situation.

In addition to the above major cause, there are some minor irregularities. For example, the called subscriber may remove the receiver, thereby stopping the ringing, and then delay his answer. If the answer is not made promptly, the person who made the call may hang up, thus giving the disconnect signal to his operator who takes down the connection. When two or more telephones are near each other, a subscriber sometimes confuses the rings, answers the wrong telephone, and reports that his bell rang. These miscellaneous conditions are minor in their effect. Added to the miscellaneous conditions for which the telephone company is responsible, they total one case in a thousand calls.

Means of Decreasing "Bell Rang" Reports

The consideration of this subject would not be complete without some discussion of ways and means for effecting a further improvement.

While less than two of the nine cases of "Bell Rang" reports in a thousand calls are now chargeable to the telephone company, constant effort is being made to realize a further improvement, if possible, as any relaxation of effort would probably mean a substantial increase. Continued efforts are necessarily directed along two main lines: first, to maintain the telephone plant as close to required standards of performance as is practical; second, to secure the highest possible degree of accuracy on the part of the young women who serve as operators. In the first case, this involves particularly all line and supervisory signals, cords, plugs, bells, ringing apparatus, frame connections, subscribers' loops, trunks and all other items of equipment involved in connecting one telephone with another, while the second case involves laying particular emphasis on the handling of numbers, attention to signals and completing connections.

As the subscribers are responsible for seven of the nine cases, there is a broad field here for improvement. It will be remembered that the ringing signal is usually heard a few seconds after the call is given to the operator. After this signal is heard, sufficient time should be allowed for the called station to answer. This interval varies considerably. If the call is to a man seated at his desk in an office, the interval is very short. If the call is to a house or an apartment, a minute or more may elapse. If the call is to an apartment house where the switchboard is attended by an elevator boy, three minutes or more may elapse. The person making the call usually knows the conditions and can gauge the interval.

The "Bell Rang" condition may be further improved if subscribers will answer their telephone calls promptly and will make an immediate response on each incoming

call. If it is not convenient to carry on conversation immediately, it would be well to indicate this to the person making the call. This is particularly important in the case of a private branch exchange operator who has plugged into a line to stop the ringing.

This analysis of the causes of "Bell Rang" reports also indicates that the condition is one that will never be entirely eliminated. With the best maintenance possible, apparatus will occasionally get out of order, and with the best possible training and supervision, operators will occasionally err. The calling party will not always be able to wait until the person called is at liberty to answer. However, if efforts are directed along the lines indicated above, it may be possible to effect some improvement, and, in any event, an understanding of the causes may make the condition a little less objectionable.

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463 WEST STREET, NEW YORK